



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE

United States Patent and Trademark Office

Address: COMMISSIONER FOR PATENTS

P.O. Box 1450

Alexandria, Virginia 22313-1450

www.uspto.gov

| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
|--|-------------|----------------------|---------------------|------------------|
| 10/613,623 | 07/03/2003 | Gregory J. McRae | 037010-0201 | 4384 |
| 30542 7590 04/07/2008 FOLEY & LARDNER LLP P.O. BOX 80278 SAN DIEGO, CA 92138-0278 | | | | |
| EXAMINER | | | | |
| CRAIG, DWIN M | | | | |
| ART UNIT | | PAPER NUMBER | | |
| 2123 | | | | |
| MAIL DATE | | DELIVERY MODE | | |
| 04/07/2008 | | PAPER | | |

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary

Application No.

10/613,623

Applicant(s)

MCRAE ET AL.

Examiner

DWIN M. CRAIG

Art Unit

2123

Period for Reply -- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 19 December 2007.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-12 and 35-45 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-12 and 35-45 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☐ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO/S508)
- Paper No(s)/Mail Date _____
- 4) ☐ Interview Summary (PTO-413)
- Paper No(s)/Mail Date _____
- 5) ☐ Notice of Informal Patent Application
- 6) ☐ Other: _____

DETAILED ACTION

1. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on 12/19/2007 has been entered.
2. Claims 1-12 and 35-45 have been presented for reconsideration based on Applicants' amended claim language and request for continued examination under 37 CFR 1.114.

Response to Arguments

3. Applicants' arguments set forth in the 12/19/2007 responses have been fully considered; the Examiner's response is as follows:
 - 3.1 Regarding the Applicants' response to the 35 U.S.C. 101 rejections of claims 1-45, it is noted that claims 13-34 have been cancelled and therefore the previously applied rejections of those claim are moot.

As regards the rejections of claims 1-12 and 35-45 as being non-statutory because the claimed subject matter amounted to nothing but software, the Examiner withdraws the previously applied rejections based on 35 U.S.C. 101 in view of Applicants' arguments and amended claim language.

- 3.2 As regards the rejections of claims 1-12 and 35-45 under 35 U.S.C. 103(a), Applicants' argued on page 8 of the 12/19/2007 responses;

"The probabilistically equivalent model is described in great detail in, for example, paragraphs [0052] to [0058] on pages 17-21, Further, Applicant has amended each of

independent claims 1, 6, 35 and 39 to recite that the equivalent model uses polynomial chaos expansion, as described in the specification in paragraph [0052] on page 17.

As noted in the earlier reply by Applicant, none of the other reference cited by the Examiner teach or suggest anything related to uncertainty analyses using probabilistically equivalent models, as recited in the independent claims and described in the specification.”

As regards Applicants' arguments that the cited reference *Malinverno* fails to teach Applicants' specific type of *probabilistically equivalent model* it is noted that the claim language fails to teach or suggest *exactly* what type of *probabilistically equivalent model* is being claimed such that the teachings of *Malinverno* can be excluded. The Examiner respectfully traverses Applicants' argument and maintains that the *probabilistically equivalent model* teachings of *Malinverno* meet the teachings of the current claim language. The Examiner is prohibited from reading a specific meaning or definition into the claim language, see MPEP 2111.01 "IT IS IMPROPER TO IMPORT CLAIM LIMITATIONS FROM THE SPECIFICATION". Therefore, the *probabilistically equivalent model* teachings of *Malinverno* read on the current claim language.

The Examiner notes that under the current grounds of rejection the newly amended claim limitation of *using polynomial chaos expansion* has not been addressed, therefore the previously applied grounds of rejection are being withdrawn.

Claim Rejections - 35 USC § 101

35 U.S.C. 101 reads as follows:

Whoever invents or discovers any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof, may obtain a patent therefor, subject to the conditions and requirements of this title.

4. Claims 1-12 and 35-45 are rejected under 35 U.S.C. 101 because the claimed invention is directed to non-statutory subject matter.

4.1 The claims are performing a Mathematical Algorithm, which is non-statutory, see section 2106.02 Mathematical Algorithms of the MPEP (Manual of Patenting Examining Procedure). More specifically and using claim 1 as an example, the claims preamble claims a method of analyzing uncertainties, uncertainties are mathematical constructs, second the claim then teaches propagating an uncertainty distribution, which is a mathematical construct, then the claim teaches a set of inputs and a set of outputs, into and out of *modules* which could be reasonably interpreted to be *functions*, which are mathematical constructs with inputs and outputs, then the claim teaches generating a model using a polynomial chaos expansion, which is a mathematical construct, finally the claim teaches providing a common data architecture for use as inputs, which could be interpreted to be a step of *normalizing* the output data, which is a mathematical procedural step or an algorithmic step.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

5. Claims 1, 4, 5, 35 and 38 are rejected under 35 U.S.C. § 103(a) as being unpatentable over US Patent 6,549,854 Malinverno in view of “OPEN SOURCE SIMULATION MODELING LANGUAGE (SML)” by Richard A. Kilgore hereafter referred to as *Kilgore* and in further view of Admission.

5.1 As regards independent claims 1 and 35 and using independent claim 1 as an example, *Malinverno* teaches, *a method of analyzing uncertainties in a system having at least two modules*, (Figure 1 reference 10 “CREATE MODEL AND INITIAL UNCERTAINTY ESTIMATE” and reference 16 and reference 24 and the descriptive text and more specifically Col. 4 lines 33-40) *comprising: propagating an uncertainty distribution associated with each of a set of inputs through a module to produce an uncertainty in a set of outputs of said module*; (Figure 1 reference 24 “UPDATE MODEL AND UNCERTAINTY ESTIMATE” and the

descriptive text and more specifically Col. 5 lines 16-56) *generating a probabilistically equivalent model of said module, said equivalent model producing a model of said outputs;* (Figure 5 and Col. 6 lines 53-67 and Col. 7 lines 1-30 the quantification of uncertainty using a Monte Carlo method is functionally equivalent to *generating a probabilistically equivalent model*),

However, *Malinverno* does not expressly disclose, *and providing said model of said outputs in a common data architecture for use as inputs by any other module in said system and* (newly amended limitation) *the equivalent model using polynomial chaos expansion.*

Kilgore teaches *and providing said model of said outputs in a common data architecture for use as inputs by any other module in said system* (Abstract page 607).

Admission teaches that using *polynomial chaos expansion* is well known in the art of uncertainty analysis, see page 17 section [0052] of Applicants' specification, more specifically, "In a *classic paper* Wiener (1938) developed the optimal representation of a random variable in terms of a series called a "polynomial chaos" expansion (PCE)..."

Admission and *Malinverno* and *Kilgore* are analogous art because they are from the similar problem solving area of performing analysis and mathematical modeling.

At the time of the invention, it would have been obvious to a person of ordinary skill in the art to have used the software simulation methods of *Kilgore* with the uncertainty analysis methods of *Malinverno*, further, it would have been obvious to a person of ordinary skill in the art, at the time of the invention to have used polynomial chaos expansion when performing uncertainty analysis.

The suggestion for using polynomial chaos expansion would be the teachings in the “classic paper” by Wiener issued in 1938 that would have been available to an artisan of ordinary skill at the time of Applicants’ invention, further and in regards to the use of PCE, this mathematical modeling method provides for a means to provide a homogeneous model of any type of nondeterministic behavior, such as the behavior of gas particles during a chemical reaction, and therefore an artisan of ordinary skill would have been motivated to use PCE in order to model a nondeterministic behavior. Further, Applicants’ specification teaches an embodiment of the invention that is analogous to calculating uncertainties for a chemical process, for which a PCE is highly suited, see page 41 paragraph [0096].

The suggestion for modifying the teachings of *Malinverno* with *Kilgore* would have been to improve the quality of common core simulation functions, and to improve the potential for creating reusable modeling components from those core functions, and further to improve the ability to merge those components using XML, HLA and other simulation community standards. See Abstract page 607 of *Kilgore*.

Therefore, it would have been obvious to have combined *Kilgore* with Admission and *Malinverno* in order to obtain the invention as specified in claims 1, 4, 35 and 38.

5.2 As regards dependent claims 4 and 38 *Malinverno* discloses *wherein said propagating said uncertainty distribution uses a Monte Carlo method* (Col. 2 lines 36-49).

5.3 As regards dependent claim 5, *Malinverno* teaches that the model is being updated and that the updated information is based on the last set of collected data, (see Col. 5 lines 33-45), the description of updating the model data and using the Measurement Data and Seismic data is a form of feedback, in which the model is modified based on updated data, therefore *Malinverno*

teaches, wherein at least one of said set of outputs is incorporated into at least one of said set of inputs in a feedback loop. The taking of the Measurement Data and Seismic data and updating the model is a feedback loop.

6. Claims 2, 36 and 3, 37 are rejected under 35 U.S.C. 103(a) as being unpatentable over *Malinverno* as modified by *Kilgore* and *Admission* as applied to claims 1, 4, 35 and 38 above, and further in view of *Sepulveda et al.* US Patent 6,173,240.

Malinverno as modified by *Kilgore* teaches a system of uncertainty analysis that outputs to a common data architecture for the reasons above, differing from the invention as recited in claims 2 & 3 in that their combined teaching lacks

(claims 2 and 36) wherein said probabilistically equivalent model is a deterministically equivalent model,

(claims 3 and 37) wherein said deterministically equivalent model is a reduced-order model.

Sepulveda et al. teaches (claims 2 and 36) wherein said probabilistically equivalent model is a deterministically equivalent model, (Col. 5 lines 25-45),

(claims 3 and 37) wherein said deterministically equivalent model is a reduced-order model (Col. 8 lines 20-25).

Malinverno as modified by *Kilgore*, *Admission* and *Sepulveda et al.* are analogous art because they are all related to simulation and modeling.

Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to utilize the uncertainty modeling methods of *Sepulveda et al.* in the

uncertainty modeling methods of *Malinverno* as modified by Admission and *Kilgore* because *Sepulveda et al.* teaches there is a need in the art to perform *Monte Carlo* sampling in less time (see *Sepulveda et al.* Col. 2 lines 61-64).

7. Claims 6, 39 and 7, 40 are rejected under 35 U.S.C. § 103(a) as being unpatentable over US Patent 6,549,854 *Malinverno* in view of “OPEN SOURCE SIMULATION MODELING LANGUAGE (SML)” by Richard A. Kilgore hereafter referred to as *Kilgore* and Admission.

7.1 As regards independent claims 6 and 39 and using independent claim 6 as an example, *Malinverno* teaches, *a method of analyzing uncertainties in a system, comprising: substituting at least one of a plurality modules of a system with a corresponding probabilistically equivalent module model, said equivalent module model adapted to propagate uncertainties in inputs of said module to outputs of said module;* (Figure 1 reference 10 “CREATE MODEL AND INITIAL UNCERTAINTY ESTIMATE” and reference 16 and reference 24 and the descriptive text and more specifically Col. 4 lines 33-40 and Figure 5 and Col. 6 lines 53-67 and Col. 7 lines 1-30), *providing outputs of each of said modules and substituting said plurality of modules with a single probabilistically equivalent system model for propagating uncertainties in system inputs to system outputs* (Figure 1 reference 24 “UPDATE MODEL AND UNCERTAINTY ESTIMATE” and the descriptive text and more specifically Col. 5 lines 16-56).

However, *Malinverno* does not expressly disclose, *a common data architecture* nor the newly amended limitation *the equivalent model using polynomial chaos expansion*.

Kilgore teaches *a common data architecture* (Abstract page 607).

Malinverno and *Kilgore* are analogous art because they are from the similar problem solving area of performing mathematical analysis and simulation using a computer.

At the time of the invention, it would have been obvious to a person of ordinary skill in the art to have used the software simulation methods of *Kilgore* with the uncertainty analysis methods of *Malinverno*.

The suggestion for doing so would have been to improve the quality of common core simulation functions, improve the potential for creating reusable modeling components from those core functions, and improve the ability to merge those components using XML, HLA and other simulation community standards. *See Abstract page 607 of Kilgore.*

Therefore, it would have been obvious to combined *Kilgore* with *Malinverno* to obtain the invention specified in claims 6, 39 and 7, 40.

7.2 As regards dependent claims 7 and 40 *Malinverno* teaches *providing an optimization module for optimizing an objective function, said optimization module adapted to receive said system outputs and to vary said system inputs* (Col. 8 lines 10-21).

8. Claims 8-12 and 41-45 are rejected under 35 U.S.C. 103(a) as being unpatentable over *Malinverno* as modified by *Kilgore* and Admission as applied to claims 6, 7, 39 and 40 above, and further in view of *Sepulveda et al.* US Patent 6,173,240.

Malvinverno as modified by *Kilgore* teaches a system of uncertainty analysis that outputs to a common data architecture for the reasons above, differing from the invention as recited in claims 8-12, 19-23, 30-34 and 41-45 in that their combined teaching lacks

(claims 8, 41) wherein said objective function is a weighted function of two or more output parameters.

(claims 9, 42) wherein said probabilistically equivalent model is a deterministically equivalent model.

(claims 10, 43) wherein said deterministically equivalent model is a reduced-order model.

(claims 11, 44) wherein said probabilistically equivalent system model is a deterministically equivalent model.

(claims 12, 45) wherein said deterministically equivalent model is a reduced-order model.

Sepulveda et al. teaches (claims 8, 19, 30, 41) said objective function is a weighted function (Col. 3 lines 19-32),

(claims 9, 42 and 11, 44) wherein said probabilistically equivalent model is a deterministically equivalent model, (Col. 5 lines 25-45),

(claim 10, 43 and 12, 45) wherein said deterministically equivalent model is a reduced-order model (Col. 8 lines 20-25).

Malvinverno as modified by *Kilgore* and *Sepulveda et al.* are analogous art because they are all related to simulation and modeling.

Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to utilize the uncertainty modeling methods of *Sepulveda et al.* in the uncertainty modeling methods of *Malvinverno* as modified by *Kilgore* because *Sepulveda et al.* teaches there is a need in the art to perform *Monte Carlo* sampling in less time (see *Sepulveda et al.* Col. 2 lines 61-64).

Conclusion

9. Any inquiry concerning this communication or earlier communications from the examiner should be directed to DWIN M. CRAIG whose telephone number is (571)272-3710. The examiner can normally be reached on 10:00 - 6:00 M-F.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Paul L. Rodriguez can be reached on (571) 272-3753. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

Dwin McTaggart Craig
AU 2123

/Paul L. Rodriguez/
Supervisory Patent Examiner,
Art Unit 2123